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Running page head

Mallard ducks observed feeding on hydrozoans

Abstract

This study presents new evidence of the extensive trophic role of gelatinous zooplankton by documenting typically non-marine predators, mallard ducks, feeding on hydrozoans in shallow, coastal environments.

Keywords

Avian; cryptic trophic linkages; gelatinous zooplankton; predator-prey; trophic pathways; *Velella velella*

Far from being trophic dead ends, gelatinous zooplankton are now known to play a host of diverse roles in ecosystem functioning (Doyle et al. 2014); from mass "jelly falls" following jellyfish blooms that act as carbon sinks (Sweetman & Chapman 2015), through to the provision of shelter for developing invertebrate and fish communities (e.g. Lynam & Brierley 2007, D'Ambra et al. 2014, Fleming et al. 2014). Moreover, aside from specialised obligate gelativores such as leatherback turtles (*Dermochelys coriacea* Vandelli, 1761; Brongersma 1969), growing evidence suggests that a vast array of taxa also consume gelatinous prey periodically (see reviews: Arai 2005, Ates 2017). Predators of note include juvenile bluefin tuna (*Thunnus thynnus* Linnaeus, 1758; Cardona et al. 2012), Atlantic bumper (*Chloroscombrus chrysurus* Linnaeus, 1766; D'Ambra et al. 2014), spiny lobsters (*Panulirus interruptus* Randall, 1840; O'Rorke et al. 2014), deep-sea 7-armed octopus (*Haliphron atlanticus* Steenstrup, 1861; Hoving & Haddock 2017) and other gelatinous species (e.g. Purcell 1981, Purcell 1991).

By contrast, episodic feeding on gelatinous species by avian predators has only been described recently, with initial reports of scyphozoan jellyfish acting as fish aggregation devices (e.g. Richardson et al. 2009, Sato et al. 2015) which can be exploited by birds. With the advent of animal-borne cameras there is also evidence of penguins *Pygoscelis adeliae* (Hombron & Jacquinot, 1841) feeding directly on gelatinous prey throughout the Southern Ocean (Thiebot et al. 2016). Here we build on this growing body of evidence by providing observational evidence of an unreported trophic pathway; the ingestion of the hydrozoan *Velella velella* (Linnaeus, 1758) by mallard ducks *Anas platyrhynchos* (Linnaeus, 1758).

Following a period of unsettled weather in the Italian district of Liguria in late May 2016, two individuals (one male, one female) were observed browsing and feeding on a large

patch of *V. velella* (Fig 1) which had been washed into the shallow harbour of Santa Margherita Ligure (44°20'1.1"N, 9°12'50.7"E on 30th May 2016, see Fig 2).

The ducks were seen feeding on *V. velella* within the hydroid patch (Fig 3); but poor lighting at the time prevented any estimates of ingestion rate or prey handling duration. Since we are not proposing that ducks feed routinely on such prey, the simple finding that such trophic links even exist is not hindered by a lack of empirical data. More explicitly, although predation on *V. velella* has been noted in a variety of oceanic vertebrate predators (Purcell et al. 2012) including several other avian species such as fulmars (*Fulmarus glacialis* Linnaeus, 1761; Williams et al. 1991), predation by typically non-marine species illustrates that the trophic role of gelatinous zooplankton can, on occasion, extend further than previously thought.

Acknowledgements

The authors would like to acknowledge the generous contribution of all grant providers and funding bodies who supported this project; The Alice McCosh Trust, Marine Institute, Society of Experimental Biology, The Sir Thomas Dixon Travel Grant, The MacQuitty Grant Scholarship and The Royal Society of Biology. N.D.P was funded by The Fisheries Society of the British Isles. All applicable international, national, and institutional guidelines for the care and use of animals were followed. This article does not contain any studies with human participants performed by any of the authors. The authors declare that they have no conflict of interest.

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Figure legends

Fig. 1 A by-the-wind-sailor or *Velella velella* washed up on Santa Margherita Ligure beach

Fig. 2 Map showing location of Santa Margherita Ligure, Italy produced using ARCGIS 10.3.1 (ESRI, California, USA)

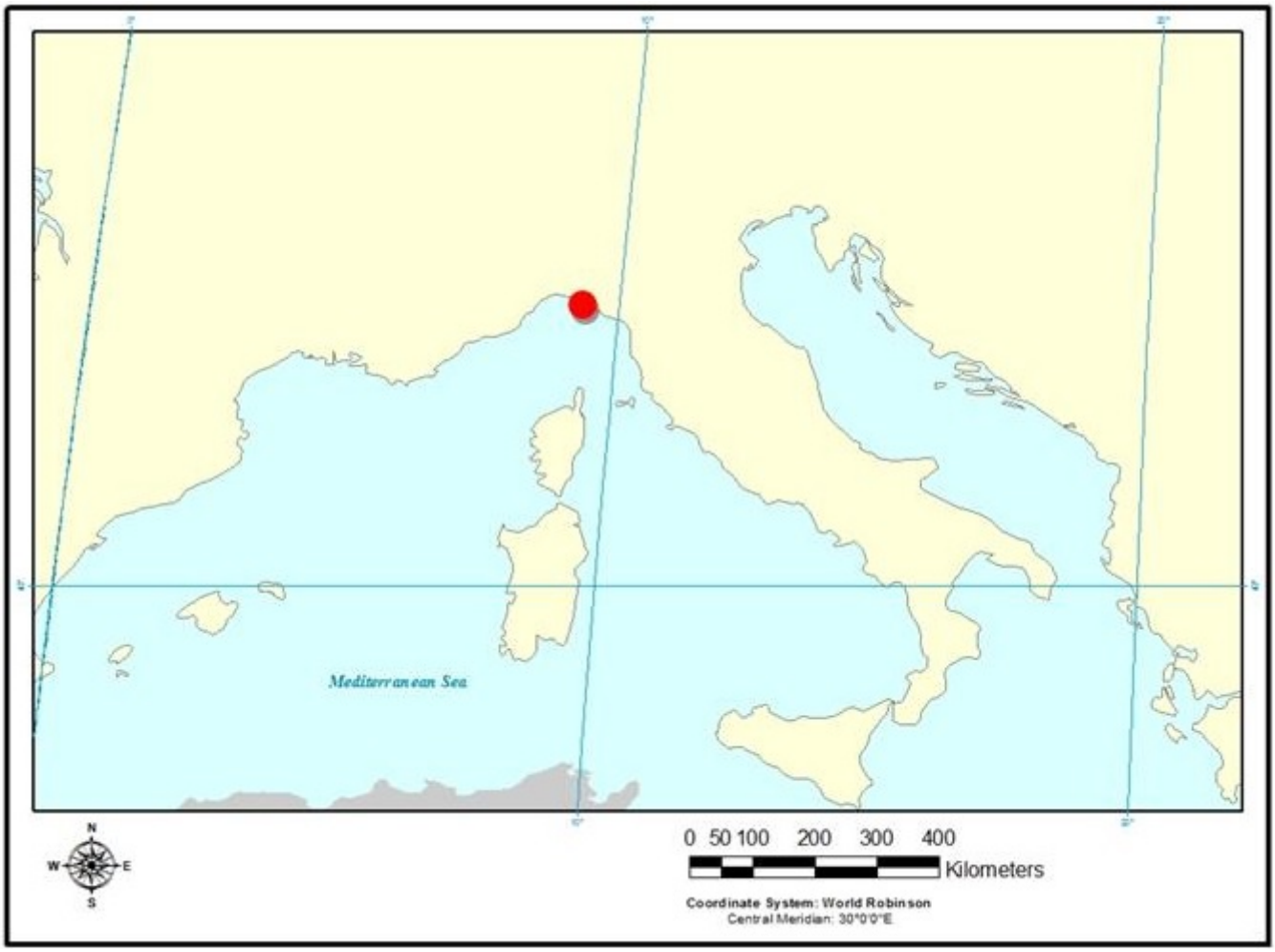

Fig. 3 Mallard ducks feeding on *Velella velella* in Santa Margherita Ligure harbour

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